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With the exception of the missing teeth, two insignificant chips from the posterior margin, and the anterior margin of the mandibular symphysis, the jaw is complete. If we may rely upon the legend accompanying the figures in Sellard's paper (no measurements are given), the present jaw is somewhat larger than his specimen, since it measures 21.5 cm. from the middle of the broken first dental fossa in a straight line to the posterior margin of the jaw, and the height from the tip of the coronoid process to the lower margin of the mandible is 14.8 cm.

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JACKING IN EAST INDIAN JUNGLES

BY HARRY C. RAVEN

Shortly after my arrival in eastern Dutch Borneo I was introduced to the sport of "jacking," that is, hunting by night with a reflector lamp. At Samarinda I became acquainted with Mr. W. C. C. Olmeyer, whose father's deeds, by the way, furnished Joseph Conrad the plot for his novel "Almeyer's Folly." To shoot the shy sambur deer at night was one of Mr. Olmeyer's hobbies. I soon realized that this method of pursuit in the dead of night offered splendid opportunities to the naturalist. He who confines his activities to the day time faces a well nigh impossible task to gather first hand information about the habits of many animals, for in these tropical jungles few of them are seen by even the keenest observers. After dusk, however, the hunter, armed with a reflector lamp, can approach the shyest as well as the most dangerous of animals with little trouble. The glare of the light directed at their eyes renders him completely invisible to them.

One night Mr. Olmeyer had heard that a "musang," a species of viverrid, had been killing fowls in a neighbor's coop. He proposed that I join him in hunting the offender. At about eight o'clock we set out, my companion carrying his reflector lamp and armed with a shotgun. Before starting he showed me how brightly the eyes of animals appeared by flashing the light at the cats and dogs about the place. Their eyes glistened like balls of fire but could only be seen by those close behind the lamp, for the reflection from the eyes of an animal is straight back towards the source of light.

Within less than ten minutes we found the "musang" stealing noiselessly towards the chicken coop. Out of the forest, only a couple of hundred yards from the house, it stealthily passed along the ditch

bordering a banana patch. We kept very quiet, for the "musang" was coming slowly in our direction.

It stopped every few steps, and stared at the light, its eyes glowing like bright patches of yellow flame. Sometimes we lost sight of the chicken thief, but as we shifted the lamp from side to side the gleam of its eyes reappeared whenever it emerged from between the bananas or from behind the fence. Apparently undisturbed by our presence it came closer and closer and, at thirty feet, received the full charge of shot. I was greatly delighted to add to my collections such a fine specimen of *Paguma*.

Next morning, at the Chinese shops, I bought my own equipment for jacking; an imported Belgian wall lamp with a six-inch reflector, a round wick, and a cylindrical glass chimney eight inches long with the lower two inches slightly larger. The base in form of a truncate cone held oil for eight or nine hours' use. The only drawbacks to it as a hunting lamp were that the glass chimney would easily crack when drops of moisture fell upon it and that any strong wind would extinguish the flame. In spite of these deficiencies, my six and a half years' subsequent experiences in Borneo and Celebes, and one year in Africa, taught me that in open fields such a simple oil lamp is recommendable. But in the forests or in caves an acetylene lamp which can be tilted up or down is preferable, as is also the case on rivers where frequent splashes due to encounters with crocodiles may crack the chimney. In out of the way places, however, carbide is not so easily procured as is oil.

Having procured the above mentioned lamp for use in the jungle I sailed out of the Mahakkam River, and northward along the Bornean coast for about three hundred miles, in a small prahu with some Moros who, originally from the Philippines, were at that time living on a little island near the mouth of the Berau River. I intended buying a boat and hiring a crew of my own, when I reached the island for which we were bound, and had with me a Chinese boy whom I had brought as my cook. The trip to the island, the buying of the boat, and the gathering together of the men who were to accompany me were all very interesting, and I was soon ready to set out. Our first camp on the mainland of Borneo was at a place called Tandjong Batoe, a long, low point that is just north of the mouth of the Berau River. There the forest has to some extent been driven back from the shore for the natives have, for years past, been in the habit of making plantings of rice and cassava at the edge of the jungle. They burn the grass during the latter part of the south-east monsoon in August or September,

thus increasing the grassy area and, unintentionally, making a better feeding ground for the large sambar deer (*Cervus equinus*). The moon was waning and did not rise until about nine o'clock in the evening so until that hour the darkness was suitable for hunting. The natives had informed me that it was impossible to hunt on moonlight nights, and this statement was corroborated by my friend Olmeyer, who told me that when the moonlight was bright the animals were able to see the hunter and would clear off before he could approach within shooting range. However, my own experience did not bear this out for I found that the reflector lamp was a complete shield to the person behind it. Though he could easily distinguish the animal in the moonlight, the hunter was quite invisible providing he kept directly behind his lamp.

Half an hour after the sun had set the darkness was complete. The natives informed me that the "paiaw," as the sambar deer is called locally, did not come out of the forests before eight or nine o'clock and it would be useless to start hunting before that time. Our camp was at the edge of the water at high tide so when all was ready we walked along the shore for a quarter of a mile or more, in order that we might be able to walk back through the open grass and cleared country to windward, for of course it would be hopeless to try to approach any animals if they were to leeward and could get scent of us. The coast at Tandjong Batoe is low and mostly level. When the leeward end of the grassy area had been reached we halted on the beach to light our reflector lamp. I decided that I preferred to carry the lamp and have the boys walk in a line behind me, with the one nearest to me carrying my rifle. It was agreed that if a deer was seen, all the other boys should stay behind and only the gun bearer follow close to me as we approached the deer; that when I decided the animal was close enough to shoot, I would give the lamp to the gun bearer and take the rifle from him.

As we started in from the shore we carefully wended our way through a mass of thorny bushes and tangled creepers and then came to a plain about a third of a mile wide by perhaps a mile and a half long, level for the most part and covered with long coarse grass known to the Malays as "alang alang." Here and there were scattered a few forest trees, usually with a mass of vines and bushes about their trunks, and also some isolated coconut trees which had been planted by the people who had originally cleared the point. There was not a sign of a trail and we wandered about through the thick grass that on the little knolls came up to our waists, and, in the hollows, reached above our heads.

We were crossing a large level part of the plain when, a little to one side and about three hundred yards ahead, I caught a glint of light; a few steps further, and I could distinctly see the reflection of four eyes. I held the lamp so that the boy carrying the rifle could see the tiny yellow balls of fire, just the color of a flame from an ordinary oil lamp. He said excitedly in a loud whisper "*paiaw dua, Tuan*" (two sambur, Mister), and then turning to the boys strung out behind him hurriedly whispered his information several times. At the same time I was telling them to be quiet lest the animals run away.

With the lamp held high, on or slightly above the level of my eyes, I began to go forward, at first very slowly and then, finding that I was more sure footed if going a little faster, I increased my speed. The deer seemed to be getting nervous and could be seen shifting their position, though as yet all that was visible was the reflection of the eyes. We were getting closer and the eyes appeared much brighter when I nearly spoiled our plans by stumbling into a muddy ditch about three feet deep. I managed to keep from dropping or breaking the lamp, however, and went on until, with a thrilling, whistling call, one of the deer turned and bounded away, but only for a few yards for it stopped and we could again see its brightly reflected eyes as it turned towards us. I approached until I could very faintly see the outline of the animal and immediately handed the lamp to the boy from whom I received my rifle. The boy stood to my left and the light from the lamp shone on the fore sight of the rifle. When the sound of the shot died away we could hear the stamping of only one deer as it bounded off into the darkness. The other was dead, the bullet having passed through the anterior part of its back almost at the base of its neck.

At Karang Tigau, another camp farther north along the coast, where I stayed for about a month at the mouth of a little river, I did a great deal of hunting at night. At this place or near it there were no native habitations, and for the month that we remained we saw no one. I had with me a Chinese boy and three sea-faring Malays, or Bajau, as they are called.

The forest at Karang Tigau was virgin and tropical and came right down to the edge of the water. At high tide the branches of some of the trees actually dipped their ends into the water which covered the sandy beach up to the line of drift. Most of my time during the first few days at this camp was occupied so fully in setting lines of traps and preparing specimens that the only hunting I did at night was to go

along the beach near the mouth of the river shortly after dark and shine the light on the water to detect fishes. Then one of my natives would throw a circular casting net and sometimes catch a bucket full of mullet-like fish at one throw.

Later on, however, I hunted nearly every night and the first time that I went out with the lamp and the gun I shot five mouse-deer within a few minutes, and within five hundred yards of camp. These little animals, which are chiefly nocturnal, are so protectively colored that during the day time they are extremely difficult to find, and, when disturbed, disappear from sight very quickly in the heavy forest which they inhabit. The natives usually hunt them with dogs. I have seen one of these animals, pursued by dogs, jump into a large river and immediately disappear beneath the surface, not coming up until it had gone about twenty yards. Then it continued, swimming on the surface until the other side of the river had been gained. On the beach at Karang Tigau where I hunted these little deer, they were usually to be found about eight or nine o'clock in the evening lying down just inside the edge of the forest, and unless the wind was unfavorable or one made some unusual noise they would pay no attention to the light. I have often approached within from six to ten feet and stood watching them ruminating. Earlier in the evening, or just after dark, they would be found walking about in the forest and if there were any wild fig trees about with ripe fruit they would be almost sure to come to feed on the fruit which had fallen.

In going up the Berau River of northeastern Borneo, I found most of the country about the delta very low and much of it swamp, overgrown with nipa palms (*Nipa fruticans*). With me on my large and clumsy sea-going prahu, were four Malays whose duty it was to row, paddle, and pole the boat. Tandjong Redeb is the principal and only real village on the river and is located about thirty-five miles from the sea. After going up-stream above Tandjong Redeb for one day's journey we passed a few clearings along the banks of the river and then for fifteen days we paddled and poled against the current of this great, beautiful, tropical stream walled in on either side by the finest of tropical forests which continued unbroken, for there was not a single native clearing, not even a hut along the banks. Behind the large prahu, we were towing a small and narrow dug-out canoe. Nearly every night on our journey up the river I took the gun and reflector lamp and hunted along the banks of the river, paddling for hours up the stream and then drifting down with the current, the whole time playing the rays of the

lamp about the banks, under the overhanging trees, between great logs and masses of roots, and up the mouths of little streamlets, even shining it high up into the great dark masses of foliage of the giants of the forest, and down into the muddy waters below.

As soon as I became accustomed to hunting at night, in order to get better results I told my natives that they must never speak while we were hunting; I sat cross legged in the bow of the canoe and, if I saw an animal, directed the rays of the lamp toward it and shook the canoe slightly as a signal to the men that they were to paddle in the direction which I thus indicated. They were not even to raise their paddles to the surface of the water lest the drip cause a sound, ever so slight, yet enough, in the stillness of the night, to arouse the suspicions or cause the flight of a wary animal.

Until this trip up the Berau River I had had no experience with crocodiles, though of course I had heard many very terrible stories about these animals from the natives and sometimes from whites as well. My first experience with a crocodile occurred one night while I was being paddled along close to the bank of the river. It was with the expectation of finding such animals as civets, jungle cats, mouse-deer, muntjac, sambur, and pigs that nightly excursions of this kind were undertaken. The canoe glided noiselessly along. Behind me were seated three Malays, one in the stern, one in the center of the canoe, and the third close behind me in the bow. The branches of the trees hung far out over the water and there were many partly submerged logs and snags. It was among these that I caught sight of the reflection from the eye of a crocodile. The reptile was headed up stream the way we were going. Holding the lamp high, I pointed with my finger at the animal hoping that the natives would see it, but they did not and as we were getting very close to it I picked up the shotgun (12 bore hammerless) which could be easily manipulated with one hand. The canoe was very flat, no part of it more than six or eight inches above the level of the water. When the bow of the canoe was within about ten or twelve feet of the head of the crocodile I fired. Only the upper part of the head with its eyes and nostrils was above the surface of the water. It seemed that simultaneously with the report of the gun there was a great splash and the next instant we were covered with spray, which broke the chimney of the lamp and nearly extinguished it. Evidently the coarse shot had glanced off the hard bones of the skull for the creature gave one great lunge and disappeared beneath the surface of the muddy water. We returned to the bigger boat and

secured a new lamp chimney and then continued our hunt for other animals. After several more experiences with crocodiles, my natives came to me and said that if I was going to continue to shoot crocodiles from a small canoe they wanted to leave my service, for they said that crocodiles had often overturned canoes and then eaten the occupants. When informed that I would be careful and that I did not intend to shoot any more crocodiles at such close range they were satisfied for the time being.

Some of the natives were very enthusiastic about hunting at night and were always delighted when they learned that I was going; others seemed to think that it was a useless sort of thing to do as the animals usually obtained were of no use to them for food, though the Dyaks as a rule would eat almost any kind of meat. On one occasion I found a group of proboscis monkeys (*Nasalis larvatus*) sleeping in the trees that overhung the river, and by getting nearly under them and playing the light on them from below for a few moments and then turning it aside for a few seconds so confused the monkeys that when we made a noise below by shouting and clapping the paddles on the water they jumped about from branch to branch. Two fell from their high perches. One caught on some lower branches and the other came down into the water and, as it was a large one was shot as it climbed out on the branches protruding from the bank.

Early in 1914 I made a trip up the Mahakkam River. It was possible to have my houseboat-like prahu of a sea-going type towed up the river as far as Long Iram by a small steamer. At Long Iram the Dutch Official, Captain Muller, very generously helped me to procure Dyaks as paddlers and loaned me a long canoe in which to travel to a Dyak village known as Long Hurei. At this place, where I found Bahau Dyaks, I sent the long canoe back to Long Iram and secured from the Bahau three smaller canoes and some of their people to take me up Long Merah, a river confluent with the Mahakkam above Long Hurei and coming in from the northward. After two days of paddling against the current and poling up rapids, the Bahau brought me to a temporary dwelling place of some Punans or nomadic Dyaks. I wished to camp among the Punans for a time, so the morning after our arrival my Bahau friends departed and I told them that when I wanted them to return for me I would send one of the Punans down to bring them word.

For a few days I camped with the Punans and then moved about half a mile down stream and made camp on the opposite bank of the river. While encamped here in the absolutely virgin forest where the

sunlight filtered through the dense foliage in slender beams of light, I shot and trapped by day and hunted with the light at night either by following the little trails made through the forest or, as proved to be more profitable, by paddling and poling on the river seated in the bow of the narrow canoe. The Punans would either squat behind me to paddle or stand to pole and maneuver the canoe where there were rapids, or where fallen trees had blocked part of the passage. I remember very distinctly that on one occasion we were quietly drifting down stream and not a word had been spoken since we left camp. The Punans stood up and took the poles and I knew we were approaching rapids. The banks of the river were rather high at this particular spot and the tall trees in some places formed an arch over the river. Long lianas hung down from branches high over the river and the roots trailed and swayed in the swiftly flowing stream. The canoe started down the rapids, guided skillfully between the rocks and away from the breakers, which, although only a few inches in height, would have been sufficient to swamp it. I continually played the rays of light from the lamp along the banks and over the river. As we were nearing the lower end of the rapids I caught the reflection of the eye of an animal ahead and to my left. The canoe was gliding swiftly, so holding the light with my left hand I grabbed my shot gun with my right, raised and fired it quickly just as the canoe was swept down the last of the rapids and came out on a sleek quiet pool where the river was somewhat wider. I then spoke to the Punans telling them that I had shot some kind of a cat for the eye had appeared bright and white. They were much surprised for they had seen nothing. They spun the canoe around and when it came along side the bank I carefully replaced my gun in the bow, after having reloaded it, and climbed out on the roots which overhung the bank. The Punans seemed surprised that I put my gun down and asked if I were not going to take it, to which I replied with calm assurance that I could tell by the reflection of the eyes that the animal was only a cat. I clambered over a mass of roots, vines, clay, rocks and dead leaves to the top of the bank fifteen or twenty feet above the river and then just as I put my hand over the broad flat buttress-like root of a large tree I touched a warm and furry body and saw before me the animal I had shot, *Felis nebulosa*, the clouded leopard, the largest of the Felidæ to be found in Borneo. It is one of the most beautiful members of the cat family, with a pattern of grays and black, somber yet handsome.

One of my Punan friends who accompanied me was a sturdy young chap named Lekio who owned a very fine "mandau," a short sword with a blade which is flat or hollow, ground on one side and rounded on the other side. His sword, which he had gotten from a Kenyah in exchange for two dogs, he prized very highly and would not sell for anything that I had to give him. However, when I shot the clouded leopard, he and all the other Punans were greatly surprised for these animals are rare. Lekio immediately began to beg for the canines of my prize, but I explained to him that I could not take out the canines without spoiling the skull for my purpose. Nevertheless he continued to beg for the teeth until he got so excited that his whole sturdy muscular body was covered with perspiration and he went away telling me and his companions that I was absolutely without pity, for he believed that the teeth which he wanted would protect him from the head-hunters of other tribes. To find out how much he valued the teeth I asked him if he would give me his "mandau" in exchange for them. He immediately brought his weapon to me but I told him I valued the perfect skull more than his "mandau" and could not exchange with him.

I was surprised to find that the reflection of the eyes of nearly all nocturnal animals could easily be seen with the light and that the different species showed considerable variation. The eyes of most insects, such as moths and butterflies, reflect a pink or reddish light, as do spiders, crawfishes, and fishes. The deer, muntjac and *Tragulus* reflect an even yellow light like the flame of an oil lamp. The wild pigs reflect a pinkish light that is rather weak and always looks small. The banteng (*Bos sondaicus*) gives a bright reflection, very pale yellowish or greenish in color, sometimes almost white.

The size of an animal may be judged by the distance between its eyes. If by chance, as sometimes happened, several deer were before the light at one time it was possible to pick out the buck because of the greater width of the head and consequently the greater distance between the eyes. The color of the reflection from the eyes, the size, the distance apart, and the height above the ground frequently furnished evidence enough so that it was possible to tell what kind of animal was being approached. Of course at first, night hawks sitting on low branches or logs would be mistaken for deer or sometimes for a civet, but it was soon learned that mammals invariably move about and do not keep the head in one position for more than a few seconds, as do the birds and reptiles.